Space Weather Technical Forecast

Issued on Friday, 28 October 2022 at 01:21 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor geomagnetic storms throughout. Slight chance of Minor (R1) Radio Blackouts throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity over the past 24 hours has been Low, with several C-class flares, although most were very low level, and the largest a C2 from AR3133. This region in the northeast quadrant has developed into a Dai/beta, and appears on the verge of developing a more complex magnetic configuration. AR3130 in the southwest quadrant initially quickly developed, increasing its penumbral extent with ongoing emergent flux south of its largest trailer spot. It is currently classified as a Dai/beta. The largest region on the visible disc remains AR3131 Cho/Beta also in the northwest, which is stable with a simple magnetic configuration. The remaining numbered region on the visible disc is AR3132, which initially developed during the past 24 hours but has since simplified again, and is currently classified as Cro/Beta. At the start of the period a CME was observed on the Earth-Sun line, associated with a filament eruption from the far south, however the CME is expected to pass to the south and well below the Earth's orbit. No other Earth-directed CMEs have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, as observed by DSCOVR at L1 started the period at background conditions with speeds generally below 400km/s, then gradually increased to slightly elevated levels, peaking at 476 km/s at 27/2343 UTC, probably due to a weak connection to coronal hole 36. The density was above average until 27/0400 UTC, peaking 15ppcc, then declined to average levels. Total IMF strength was generally weak, but did peak at 10 nT at 27/1729Z as the weak HSS arrived. The north-south component, Bz, varied between 5nT and -7nT, and was often weakly negative (southward) direction. The phi angle was predominantly positive (away from Sun) albeit with brief rotations to negative. Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2MeV) at GOES-16 was predominantly at background levels. The associated 24-hour integrated fluence was well below the Active (1e8 integrated pfu) threshold, with 1.24e6 integrated pfu observed at 28/0000UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is expected to be mainly Low, but with a daily slight chance of isolated M-flares due to the developing sunspot regions on the disc. These most likely from AR3130 or AR3133.

Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs. Coronal hole fast wind enhancements are expected at times throughout the period, with a weak HSS most likely in place at first from CH36/+.

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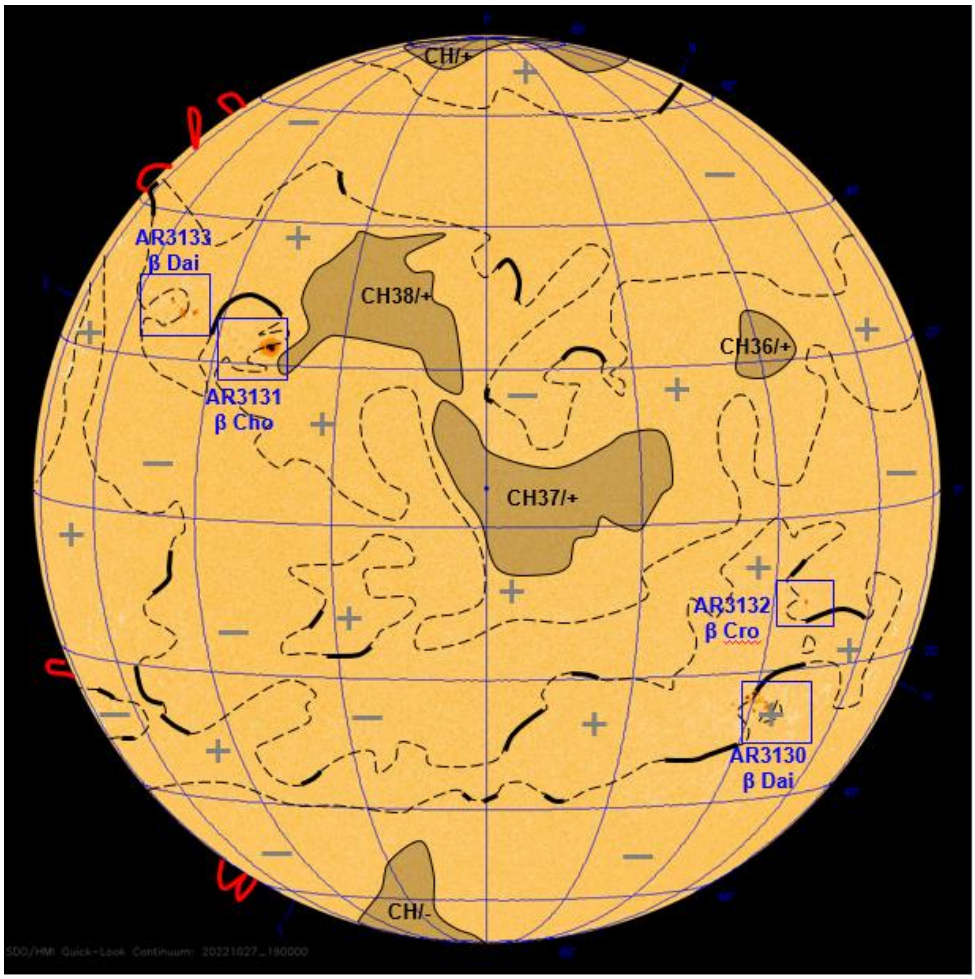
A more notable HSS is then expected from CH37/+, later tomorrow (29th) and into day 3 (30th), with slightly elevated or elevated winds persisting until the end of the period (31st). Quiet to Unsettled (Kp 2-3) geomagnetic activity at first, with a chance of isolated Active (Kp 4) intervals. Then from late tomorrow (29th) mainly Unsettled to Active activity is expected, with a chance of a G1/Minor geomagnetic storm (Kp 5), especially late tomorrow into day 3 (30th).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) observed by GOES-16 is expected to be at background levels. High energy electron flux (greater than 2MeV) observed by GOES-16 is expected to be at background levels initially, then gradually rising to mainly moderate levels by the end of the period. The associated 24 hour electron fluence is expected to remain below the Active threshold.

Figure 1. Solar Analysis Valid 27/1900 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

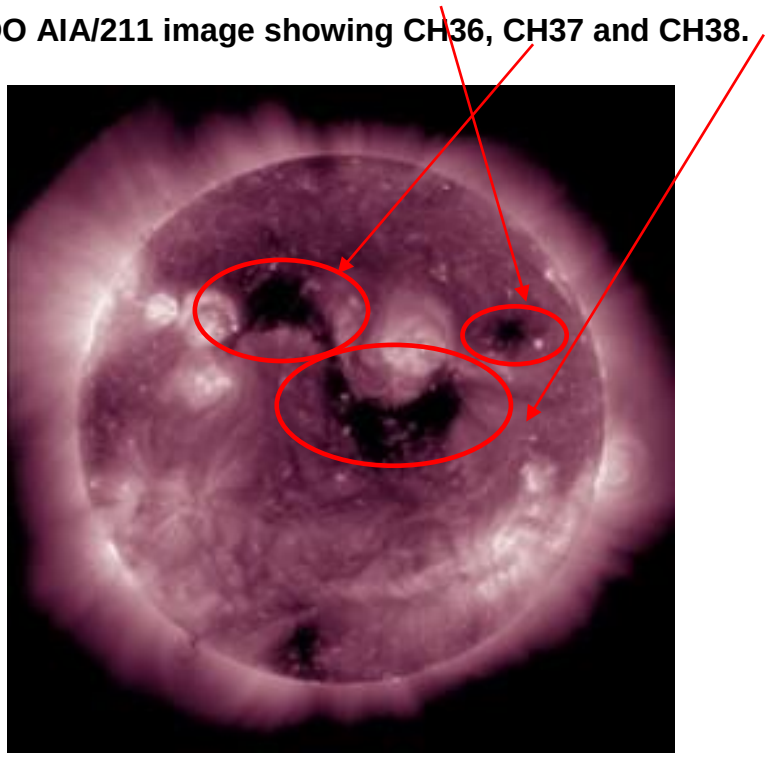
There are no Earth-directed CMEs.

There are a series of coronal holes on the Earth-facing disc. These are recurrent features, with solar wind persistence from the last 27 day rotation providing a good guide to likely conditions. CH36/+ is the leading coronal hole, with the associated HSS already arrived, with wind speeds probably 470-520 km/s today. The next HSS is expected to arrive late tomorrow (29th) from CH37/+, with speeds reaching 500-550 km/s through days 3 and 4. Another HSS from CH38/+ may arrive late on day 4 (31st), maintaining the elevated wind speeds.

Quiet to Unsettled (Kp 2-3) geomagnetic activity at first, with a chance of isolated Active (Kp 4) intervals. Then from late tomorrow (29th) mainly Unsettled to Active activity is expected, with a chance of a G1/Minor geomagnetic storm (Kp 5), especially late tomorrow into day 3 (30th).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	40	40	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Figure 2: Recent SDO AIA/211 image showing CH36, CH37 and CH38.



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Radio Blackouts - X-Ray Flares:

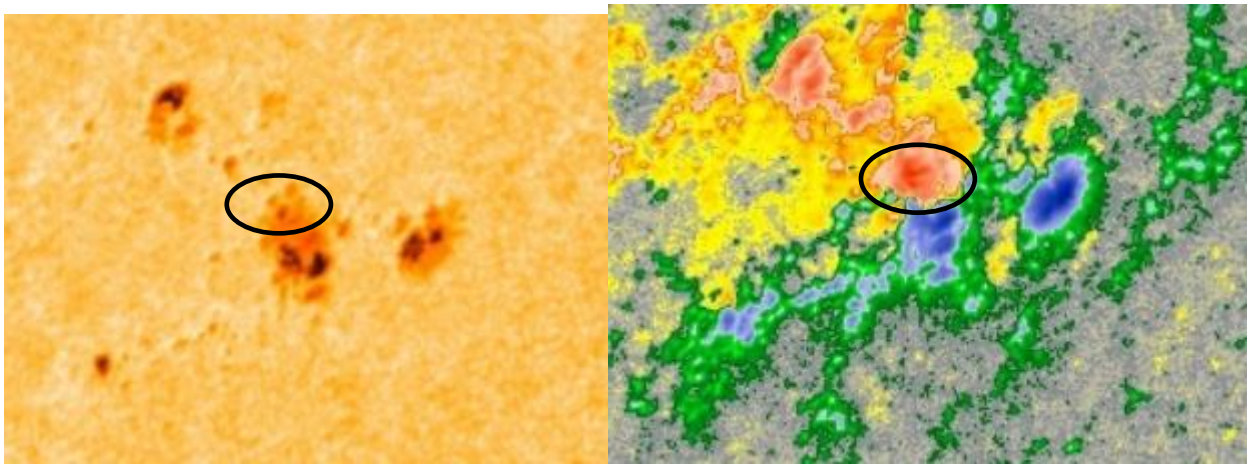
Solar activity over the past 24 hours has been Low, with several C-class flares, although most were very low level, with the largest flare a C2 at 27/0126 UTC originating from AR3133.

There remains a slight chance of activity increasing to Moderate, with isolated M-flares. These most likely from AR3130 in the southwest, or AR3133 in the northwest, with lower chances from the other regions. AR3133 (Dai/beta) appears on the verge of becoming a more complex magnetic configuration, with a possible small and weak delta spot trying to develop.

A further source of potential activity is a large region of magnetic looping notable on SDO imagery on the northeast limb. This is supported by a strong signal in helioseismic products, suggesting the potential for a further notable region or regions to rotate onto the northeast disc through the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	15	15	15	15
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: AR3133 with potential weak delta spot trying to develop.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES16 is currently at background. The current sunspot regions on the solar disc are unlikely to produce observable radiation storms at Earth, although a very slightly above background risk has been introduced due to AR3130 in the southwest quadrant.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	2	2	2	2
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux as measured by GOES-16 has been largely at background levels. Throughout the period the solar wind is expected to be at slightly elevated to elevated levels, with the flux gradually increasing to mainly moderate levels, perhaps peaking at high levels during day 4 (31st).
The associated electron fluence is expected to remain below the Active threshold through the period, but with an increasing trend. This is supported by both REFM and recurrence.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	10	20	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 4: Met Office REFM model.

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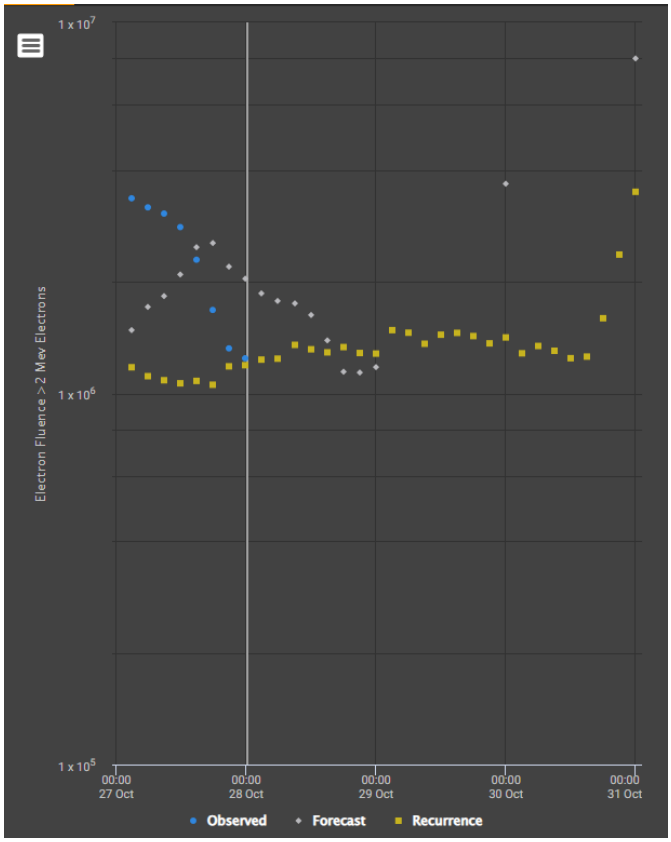

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